REMARKS

Claim 45 is amended to recite a time-division reuse pattern and directing a beam to a direction in response to the ordering of data packets. Support for these amendments is found in the Specification as filed, as discussed herein. No new matter is added.

The Examiner rejected claim 39 under 35 U.S.C. § 103 as being unpatentable over U.S. Patent No. 6,157,621 to Brown, *et al.* ("Brown") in combination with U.S. Patent No. 5,859,835 to Varma *et al.* ("Varma"). Brown discloses a satellite communication system comprising a constellation of 840 spacecraft in low Earth orbit (435 miles). The satellites are arranged in 21 orbits of 40 spacecraft each. Col. 5, lines 11-14. Each satellite generates 256 steerable beams. Col. 6, lines 8-10. Brown divides the surface of the planet into 1.28 million "Earth-fixed cells," each 20 km x 20 km, which are packaged in 4x4 arrays of "Earth-fixed supercells." Col. 20, lines 54-58. Each supercell is served by a steerable beam, that time-division multiplexes, or "hops" from cell to cell in a spiral pattern, as depicted in Fig. 46. "The cells are scanned in a regular cycle by the satellite's transmit and receive beams, resulting in time division multiple access (TDMA) among the cells in a supercell." Col. 61, lines 24-27. Thus, the pattern and timing of beam steering is fixed.

Data packets are autonomously routed at every node (e.g., satellite) in the system, in a "datagram" fashion. Col. 17, lines 10-20. The routing is based on a destination address in the header of the packet. Col. 17, line 56 – col. 18, line 14. "An incoming packet Pk ... progresses through mapping and switching hardware which directs the packet Pk to the Earth-fixed cell beam 1219 <u>which is currently serving the Earth-fixed supercell</u> 1224 and cell 1226 in which the destination terminal resides." Col. 60, lines 32-36. See, generally, col. 60, line 30 – col. 61, line 11 for details of the dynamic translation of a destination address in the packet header to a satellite, beam, and channel (*e.g.*, frequency, code, or time slot).

The sole disclosed focus of this autonomous routing system is to deliver data packets to the proper satellite, beam, and channel for transmission to a receiver. As well known in the communication arts, such autonomous routing will result in out-of-order delivery. Ordering of the packets is accomplished in the receiver. Brown has nothing to gain (and precious processing resources to waste) ordering packets at a routing point by timestamp. In particular, the Examiner's proffered motivation for adding timestamp inspection to Brown – to avoid queue stalling – is completely inapposite to the process of data packet routing diagrammed in Fig. 48. There is simply no suggestion whatsoever in Brown that ordering data packets by timestamp would be in the least bit advantageous. Consequently, nothing provides any motivation for the proffered combination with Varma other than claim 45.

The present invention relates to a phased array antenna having steerable beams. In particular, an inventive feature of the arrangement of power amplifiers and other circuit components (claimed in a parent application) results in each beam benefiting from the full power of the entire array, and virtually eliminates intermodulation distortion. A salient characteristic of the inventive antenna array is that it comprises a plurality of beams, each arrayed along a first direction (such as horizontally, for reference). Each such beam may be steered in a second, orthogonal (e.g., vertical) direction. This configuration results in a side-by-side array of vertical "fans," within each of which precisely one beam may be steered to any vertical position. This arrangement is depicted in Fig. 6. Because each "fan" or column includes only one beam, Figs. 10A-10D depict allowed and disallowed configurations of beams, using the same frequency. In Figs. 10A and 10B, only one beam is active in any column, and there is sufficient separation between the beams to avoid co-channel interference. In Fig. 10C, the first column includes two beam; an impossibility with the inventive antenna array. In Fig. 10D, the beams in columns 1 and 2 are too close and would result in co-channel interference.

An inventive concept, given these constraints and the characteristics of the inventive antenna array, is to employ a re-use pattern, analogous to the frequency re-use planning known

in the cellular communication arts, in a time-division fashion. Fig. 11 shows one such configuration, with a three-part pattern. In a first time slot, beams may be directed to any of the "1," or shaded, beam positions, which exhibit sufficient distance from each other to avoid co-channel interference. During a second time slot, beams may be directed to any position marked "2," and during a third time slot, to those marked "3," and avoid co-channel interference. See p. 21, lines 4-12.

Note that there are two possible allowed beam positions for each column (with the exception of column 6). However, the relevant beam may be steered to only one of the shaded positions in each column, since each column has only one steerable beam. See p. 12, lines 13-22. Within this scheme, in a given time slot, within a given column, several beam positions are allowed, but the beam may be directed to only one. Which one should be selected? According to the invention of claim 40, the beam should be directed to the position that corresponds to the destination of the oldest data packet pending delivery.

> At any instant, which of the allowed spots in a column, or fan, that is actually selected may depend for example on the backlog of traffic for that particular spot. If no traffic exists for a spot, it is of course not a candidate to be selected. If a data packet destined for a user in a particular spot has been waiting in a queue for a period of time longer than data packets destined for other spots belonging in the same timeslot reuse group, then that spot would be preferentially selected within the column for illumination at the earliest opportunity, i.e., upon the next occurrence of its timeslot.

Specification, p. 21, line 22 – p. 22, line 4. Thus, the beam position is determined in response to the timestamps of data packets within a subgroup defined by the spots within a given column that are in an upcoming timeslot reuse group. Brown – alone or in combination with Varma – does not teach or suggest altering the positioning of steerable beams in response to the timestamp of a data packet. Brown teaches away from such an idea by disclosing a regular

(spiral-shaped) beam steering pattern for each supercell, and directing data packets to the beam currently serving the destination cell.[1]

Claim 40 is amended herein to recite a time-division reuse pattern, and to explicitly recite that the oldest data packet is transmitted first by steering the beam to the position associated with that data packet in response to the timestamp. Nothing in Brown or Varma teach or suggest either limitation. Accordingly, all pending claims are allowable over the art of record, and prompt allowance of all pending claims is respectfully requested.

Respectfully submitted,

COATS & BENNETT, P.L.L.C.

Dated: June 30, 2005

Edward H. Green, III
Registration No.: 42,604

P.O. Box 5
Raleigh, NC 27602
Telephone: (919) 854-1844

[1] Brown employs a form of time-division frequency re-use planning in that the timing of the scanning pattern for adjacent supercells is offset such that adjacent cells are never covered by an active beam at the same time. Nothing about this scanning pattern timing, however, relates in any way to the timestamps of data packets.